

TECHNOLOGY MANAGEMENT

MONTHLY SUMMARY

January 2002

This Month's Highlights:

K Basin Report Availablepage 2

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Outer Welds Evaluatedpage 2

Since the Bagless Transfer System was deployed at the Plutonium Finishing Plant, outer can welds have been plagued with weld porosity. Several investigations have been initiated by PFP management to solve the problem, and one of these included the use of very high frequency ultrasonic testing to provide rapid information on weld integrity.

Results In from High Chloride Oxide Testpage 3

Preliminary results from the test run at PFP have revealed that much less salt was removed than had been predicted. For the process to be considered a success, nearly all of the volatile salts must be removed. Analytical results will be available in early February, and will establish the effectiveness of the process.

Technical Support for K Basin Deactivation.....page 3

The Spent Nuclear Fuel Project is gearing up for the deactivation of the two basins from which over 2,100 tons of spent fuel will be removed. After the fuel has been transferred, the basins will need to be emptied of the contaminated water, and the concrete cleaned sufficiently to allow the basins to be deactivated. A technical review is being considered that would review the proposed endpoint, the regulatory path, and the technical methods to be used.

NMFA MidYear Reviewpage 5

Nuclear Materials Focus Area's mid-year review is scheduled for February. This review will feature information on progress and accomplishments of the focus area.

FY02 Planned Deployments.....page 7

TECHNOLOGY MANAGEMENT

MONTHLY REPORT

January 2002

K-Basin Fuel Reactivity Behavior Report Issued

The document "K-Basin Spent Nuclear Fuel Reactive Behavior" was completed by John Abrefah and others at PNNL and transmitted to the Hanford SNF Project staff for review. In the report, oxidation kinetics data on the degraded K-Basin spent nuclear fuel in three atmospheric conditions is analyzed to enhance the technical basis that supports the ongoing project to treat the N-Reactor spent fuel for the interim dry storage facility. Available Residual Gas Analyzer (RGA) data from the multi-canister overpacks utilized in the Hanford cold vacuum drying process is evaluated to assess fuel reactivity. Available data on single fuel elements from K-Basin have been analyzed to better characterize the surface area expected from N-Reactor fuel. The data from this activity is expected to provide significant support to the site SNF safety basis. (POC: Bill Bonner)

Technical Task Plan Submitted for ASTD Project

The Waste Management Project has submitted a Technical Task Plan (TTP) for their project to convert the LLW glovebox to handle contact handled transuranic waste. The plan has been delivered to DOE, with anticipation of funds in the February financial plan. The project will be initiated as soon as funds are available. (POC: Paul Scott)

Ultrasonic NDE Technology Evaluated for DOE-STD 3013 Can Welds

Since the Bagless Transfer System was deployed at the Plutonium Finishing Plant (PFP), the outer can welds have been plagued with weld porosity exceeding the acceptance standards. Several investigations have been initiated by PFP management to solve the problem, and one of these included the use of very high frequency ultrasonic testing to provide rapid information on weld integrity. While radiography is an industry standard for this type of evaluation, the use of that technology is expensive and presents a challenge in the area of the Bagless Transfer System, where radiation alarms can be triggered by the X rays used.

Several weldments of the outer can lids were provided to PNNL for testing with an existing UT testing apparatus. The setup had been developed to support examination of welds in existing nuclear power plants, and was immediately available to conduct a proof-of-concept evaluation. Tests of the weldments showed that the UT could not identify the sub-millimeter pores of concern in the weld with the apparatus as it was configured. PNNL scientists speculated that the acoustic energy was being scattered by the weld material, preventing the signal from detecting flaws that were intentionally introduced for the purpose of the test. This was considered to be a surmountable problem, but would require some development and fabrication of custom hardware to handle the DOE-STD 3013 cans efficiently. As such, no further action will be

taken on this approach, unless other attempts to solve the welding problem fail. (POC: Paul Scott)

Preliminary Results from High Chloride Oxide Test

A second (and last) test was conducted in December of a concept to volatilize chloride salts from impure Pu oxides processed at PFP. This concept, if successful, would obviate extensive operator time and dose required to wash these troublesome materials from the Pu. If not removed, the salts will vaporize during the high temperature stabilization process, causing unacceptable corrosion of the off gas system.

Preliminary results from that test have revealed that much less salt was removed than had been predicted. For the process to be considered a success, nearly all of the volatile salts must be removed. Analytical results will be available in early February, and will establish the effectiveness of the process. This work was funded by the Nuclear Materials Focus Area. (POC: Paul Scott)

Large Contaminated Equipment (LCE) Processing

Work continued to support a strategic assessment on large, contaminated equipment (LCE) processing needs among Fluor Hanford's projects. This assessment, sponsored by FH Technology Management, is expected to document and recommend a path forward for meeting Fluor Hanford's needs to process LCE (e.g., gloveboxes, ducting, hoods, vessels, small tanks, etc.). Input from multiple projects and the collaboration and transfer of experience from other sources (e.g., other DOE sites, EM-50 Focus Areas, and international projects) is being gathered to support decisions on the optimal mix of centralized -vs.- mobile processing as well as technology options. The multi-project team

recently held an all-day session to focus on (1) D&D technologies and experience with LCE, and (2) regulatory strategies and considerations for processing LCE. Presentations were given on the iPIX 360-degree camera, SA Robotics' products and recent support to the processing of gloveboxes at Rocky Flats, French D&D experience, and BHI's experience/lessons-learned while decommissioning Hanford's 233-S facility over the last several years. (POC: Greg Berlin)

The LCE working group initiated a requirements review process to establish the technical/performance, regulatory, and disposal requirements related to LCE processing. A database was developed to collect results of a review of equipment related requirements undertaken by representatives by PFP, Waste Management, and the 300 Area River Corridor projects. Data on waste disposal related requirements were compiled.

The LCE working group planned and hosted a visit of representatives from Rocky Flats to provide insight on their glovebox processing project. The technical exchange meeting was a great success and the project team was able to learn from another site's experience in multiple areas, such as processing and disposal strategies, work procedures and processes used, characterization methods, decontamination processes, and dismantlement, packaging and transportation. (POC: Betty Carteret)

Technical Support Being Defined for K Basin Deactivation

The Spent Nuclear Fuel (SNF) Project is gearing up for the deactivation of the two basins from which the project is removing over 2,100 tons of spent fuel. After the fuel has been transferred, the basins will need to be

emptied of the contaminated water, and the concrete cleaned sufficiently to allow the basins to be deactivated. The extent of contamination that may have diffused into the concrete is not known, and that information is needed to plan the deactivation effort. Two approaches will be pursued: core samples will be taken above and below the water line, and non destructive assay techniques will be used to map the levels of contamination both above and below the water line. The core sampling will not occur for several months, but the mapping may be started earlier. The project has asked for PNNL support to conduct the non-destructive assay work. Further, the project is considering a technical review, to be conducted by Technology Management (TM) that would review the proposed endpoint, the regulatory path, and the technical methods to be used. (POC: Paul Scott)

SNF Support

PNNL staff performed analyses to evaluate gas bubble behavior with sludge in the large diameter containers (LDC). Results from these analyses were presented to the SNF project. In January, direct SNF project support was provided to document the results of these analyses in a PNNL report. The report will also include a discussion on the range of parameters and their potential impacts on the analyses (e.g., effect of mixing floor and canister sludge, effect of compression and compaction of the sludge).

SNF project support was also provided to document the basis for gas retention in sludge. A fraction of the gas bubbles generated from the corrosion of uranium metal and oxides may be retained within the sludge matrix. Entrapped bubbles will expand the sludge bed volume and will reduce the thermal conductivity of the sludge. Free board must be provided in the LDC to account for gas retention.

In FY2001, under a TM activity, a calculation note on K Basin sludge expansion during storage was prepared and issued for review. Under the SNF Sludge Handling Project, further work on the sludge expansion evaluation was continued. In January, the evaluation was issued as, "PNNL-13786, "Assessment of K Basin Sludge Volume Expansion Resulting from Uranium Corrosion During Storage." The purpose of the report is to quantify how the various types and sources of K Basin sludge will react and volumetrically expand between the time the sludge is first loaded into the storage containers (starting state) and the time all major volume-changing reactions have been completed (end state). K Basin sludge contains metallic uranium and uranium oxides that will corrode and hydrate during storage. The end-state (final) corrosion products will have a lower particle density and a higher void fraction (or volume fraction of sludge occupied by water) than the starting-state sludge at the beginning of storage. It is expected that the results from this report will be used in design and safety basis calculations for sludge management systems and will be incorporated into the sludge technical basis documents. (POC: Andy Schmidt)

SNF Basin Deactivation

TM brought to the attention of the SNF project staff two technologies that could support the project in the deactivation activities at K Basin. One is a hydraulic shear manufactured by HyDRAM of France. This tool deployed in various D&D activities in the COGEMA facilities is actuated by dematerialized water and could cut 1" steel cables located underwater at the bottom of the basins. A proposal from HyDRAM has been submitted to the project engineering staff. The second is software developed by ONECTRA of France, for non-destructive

measurement of radionuclides that migrated into concrete walls. This method could be considered in the definition of the non-destructive assay techniques that will be used to map the levels of contamination in the K basins. (POC: Eric Tchemitcheff)

NMFA Mid-Year Review

Information on the progress and accomplishments of the Nuclear Materials Focus Area (NMFA) and TM support to PFP's Solutions Stabilization Project have been compiled and summarized for the FY2002 NMFA Mid Year Review scheduled in February. (POC: Andy Schmidt)

Product Calcination and Moisture Uptake Testing at PFP

Based on the testing results (conducted at PNNL and PFP), PFP was authorized this month to begin processing the Critical Mass Laboratory (CML) solutions in the PFP RMC line with the use of Loss of Ignition (LOI) to measure moisture in the calcined product. Processing of CML at PFP started the week of January 7-11, 2002, and 300 liters of CML were processed. Results of the calcination and moisture uptake testing, and the associated precipitation testing, were reported in two letter report updates this month. (POC: Andy Schmidt and Cal Delegard)

Testing for Single/Double Pass Filtrates in Support of PFP

The PFP solutions stabilization team soon will begin processing the single/double pass filtrates (SPF/DPF) obtained by concentration and oxalate decomposition of filtrates from prior (1980s) Pu(IV) oxalate precipitation processing. Besides Pu, the SPF/DPF contain iron, chromium, nickel, and aluminum and are notably high in sodium and potassium. In July 2001, a full-scale process test was conducted in which a batch of DPF was treated with oxalic acid. A sample of the process test

filtercake was calcined and then observed to gain ~2.5 wt% after 12 hours exposure to the normal humid glovebox atmosphere and 3.7 wt% after 12 days. Separate samples of calcine that were rinsed in water and then re-calcined gained 0.66 wt% after 20 minutes and 2.3 wt% after 5 days. Note that the threshold limit for moisture in materials for DOE-STD 3013 packaging is 0.5 wt%. A sample of the original calcine, after extended (weeks) exposure to glovebox air, was added to dilute nitric acid and observed to form bubbles.

A means to remedy the hygroscopicity is has been identified. With the addition of a small quantity of silica (SiO_2) or aluminosilicate [the clay kaolin, $\text{Al}_2\text{Si}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$] to react the Na and K oxide at the 1000°C calcination temperature, the less hygroscopic products Na_2SiO_3 and NaAlSiO_4 products (sodium metasilicate and nepheline, respectively) can be formed. The conversion of the Na and K to the less hydroscopic products should also should minimize or eliminate volatilization of sodium/potassium (hydr)oxides, which can contribute to the LOI in subsequent product testing.

Testing has shown that significant decreases in the hygroscopicities of simulant product calcines (with and without plutonium addition), have been obtained for both silica and kaolin additives. Initial tests with surrogates exhibit <0.1 wt% moisture uptake at 24 hours with both silica and kaolin. Simulant tests to establish optimum additives and dosages are underway as are preliminary tests with Pu-bearing simulants. The approach of using additives for stabilization of the SPF/DPF solutions is being discussed with PFP, DOE-RL, and NMFA staff. (POC: Andy Schmidt and Cal Delegard)

Miscellaneous Solutions at PFP

Approximately 50 miscellaneous solution items (cans) exist at PFP that must be addressed as a part of the Solutions Stabilization Project. These include items designated as Chlorides, Organics, Caustic (PRF Spill), Flushes, etc. This month a workshop was conducted to develop a "project plan" which evaluates each can and identifies the disposition path and schedule. PNNL took the action to document the plan. The baseline plan developed for most of the miscellaneous solutions is to stabilize them using the oxalate precipitation process. It was also proposed to blend the caustic solutions with other solutions containing high concentrations of nitric acid. Because a relatively small quantity of oxide solids will be generated from the miscellaneous solutions, TGA/MS will be pursued to verify compliance with 3013 moisture criteria. The addition of silica or kaolin will be considered as a technique to insure the oxide product exhibits low moisture uptake. (POC: Andy Schmidt, Mark Gerber, Bruce McNamara and Cal Delegard)

Support to the FFTF Deactivation Project

Following the decision of the Secretary of Energy that the DOE will proceed with the deactivation of FFTF, a white paper was drafted and submitted to FH senior management and the FFTF Director that provides an overview of the French expertise and references in shutdown and D&D activities of fast breeder reactors, relevant to the Hanford FFTF project. This white paper summarizes the vast expertise existing in France, gained from successful D&D and sodium processing activities at Rapsodie (40 MWt), Phenix (560 MWt) and Superphenix (3,000 MWt), which could be beneficial to the future programs and activities of the Hanford FFTF project. (POC: Eric Tchemitcheff).

AEA ARTISAN Arm Update

AEA Technology and Engineering Services, Inc. have completed the design and installation of roller bearing assemblies to improve the ease of installing/removing the ARTISAN robotic arm through hot cell manipulator ports. AEA is also working on the design for fabrication and testing of an A-frame installation stand for the ARTISAN. AEA currently plans to perform Factory Acceptance Tests for both the A-frame stand and the ARTISAN system at their Pittsburgh facility in late March and then deliver the entire system to Hanford by mid-April. Discussions are underway to consider display of the ARTISAN system at the local Safety Expo from April 30 - May 3. (POC: Greg Berlin)

327 Building ASTD Project Update

DOE-RL has received EM-50 funding for the ASTD proposal entitled "Technology to Support Monolithic Disposal of 327 Building Hot Cells." FH recently learned that \$735K of the \$935K award will be authorized this fiscal year; EM-50's ASTD Program plans to provide the additional \$200K in early FY2003. Transfer of funds from DOE-RL to FH is pending RCP's completion of a Technical Task Plan. This project should be initiated before the end of February. (POC: Greg Berlin)

Website for the West Valley Demonstration Project's LSDDP

A new website has been posted to describe the multi-year Large Scale Demonstration and Deployment Project (LSDDP) that EM-50 has recently funded to support hot cell deactivation at the West Valley site, Battelle Columbus -- West Jefferson Laboratory, and Hanford's 324 and 327 Buildings. The web address is <http://www.wv.doe.gov/lsddp>. (POC: Greg Berlin)

Upcoming D&D Focus Area Mid-Year Review

The Deactivation and Decommissioning Focus Area (DDFA) Mid-Year Technical Review Meeting will be jointly held with the Subsurface Contamination Focus Area (SCFA) in Salt Lake City on March 5-7, 2002. The SCFA and DDFA will conduct a plenary session on the first half-day of the session, and likely speak to the pending changes to DOE's Office of Science and Technology (EM-50). During the remainder of the SCFA/DDFA Mid-Year Review, the SCFA and DDFA will

conduct concurrent sessions to review their respective programs and projects. A number of presentations will be made concerning Hanford River Corridor Project's EM-50 funded tasks (i.e., the Cybernetix Robotic Work Platform, the AEA ARTISAN robotic arm, the LSDDP involving West Valley/Battelle West Jefferson/Hanford's 324 & 327 Building hot cells, and the recently funded ASTD project concerning monolithic disposal of the 327 Building hot cells). (POC: Greg Berlin)

Planned FH Technology Deployments – FY 2002

DEPLOYMENTS	Planned deployment date	Point of contact
<i>River Corridor</i>		
• ARTISAN Telerobotic Arm	Sept 2002	Kurt Lenkersdorfer
• CARTOGAM Gamma Camera	July 2002	Dale Dutt
• In Situ Object Counting System	Aug. 2002	Dale Dutt
<i>Spent Nuclear Fuel</i>		
• Canister Cleaning System	Jan. 2002	Nick Capron
• Scrap Classification and Handling System	June 2002	Nick Capron
• Basin Wall Characterization	April 2002	Nick Capron
• K-East Fuel Retrieval System	Aug. 2002	Nick Capron
• MCO Gas Sampling	Jan. 2002	Nick Capron
<i>Nuclear Material Stabilization</i>		
• Radio Frequency Tag Unit	April 2002	Kurt Silvers
<i>Waste Management</i>		
• Large Size Hydraulic Shear	Feb. 2002	Bill Ayers
• 100 HP Vacuum Cleaner with HEPA Filter & 55 gal drum	Feb. 2002	Bill Ayers
• Clamshell Waste Retrieval System	Jan. 2002	Bill Ayers
<i>Analytical Laboratories</i>		
• Hydroxide Analysis Using Capillary Zone Electrophoresis (CZE)	Aug. 2002	Steve Metcalf
• Electrochemical Corrosion Polarization Measurement	April 2002	Bill Winters

Planned FH Technology Demonstrations – FY 2002

DEMONSTRATIONS	Planned demo date	Point of contact
<i>River Corridor</i>		
• B-Cell Duct Inspection Robot	April 2002	Dick Steen
• In-Cell Small Size Liquid Waste Evaporation Unit	Aug. 2002	Dick Steen